DOCKET NO: 285336US0PCT

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
CARINNE FLEURY, ET AL.	GROUP: 1794
SERIAL NO: 10/567,901	:
FILED: DECEMBER 7, 2006	EXAMINER: NELSON
FOR: TRANSPARENT SUBSTRATE COMPRISING AN ANTIREFLECTION COATING	:

DECLARATION UNDER 37 C.F.R. 1.132

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

I, Stephanie Roche state that:

1. I am a graduate of Paris XI University and received my PhD in 2001.

2. I have been employed by Saint-Gobain Recherche for 5 years as a Research Engineer in the field of thin film deposition.

3. I am familiar with the specification and claims of this application.

4. I understand that the claims have been rejected by the U.S. Patent Office as obvious in view of WO01/37006 (Joret) using the US equivalent, US 6,924,037 combined with Wolfe, US 5,563,734. The Wolfe patent is also cited by itself and both Joret and Wolfe are further combined with other publications to allege that certain dependent claims are obvious.

5. I disagree with the rejections.

6. Wolfe in col. 4, lines 32-36 describes that the refractive index must be limited in a range between 1.98 and 2.08 for the second dielectric layer, i.e., the layer placed above the

silver layer, where a composite film of SiZrN type is placed. These values are acknowledged in the rejection on page 3, last paragraph and page 6, lines 3-6 of the Official Action.

7. Wolfe has required the second dielectric layer between 1.98 and 2.08 becomes apparent when Wolfe's teachings in col. 4, lines 38-41 are taken into consideration where Wolfe discussed that the layer should exhibit a low intrinsic stress.

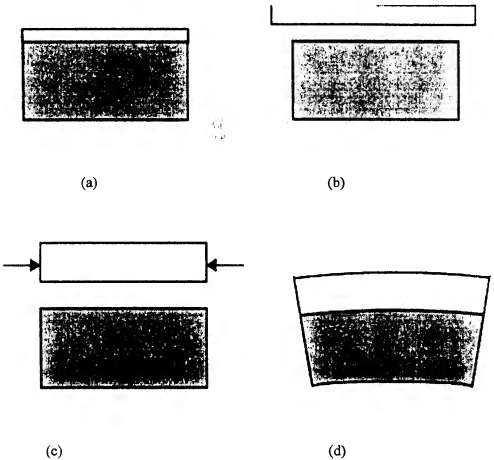
8. Indeed, contrary to the conclusion raised by the U.S. patent office, one would not have increased the Zr content because it was thought that increased Zr would increase the intrinsic stress, something Wolfe clearly states is not desirable.

9. Intrinsic stresses develop during the sputtering deposition of materials. These stresses are not due to lattice mismatch or thermal mismatch strains and are therefore called intrinsic stresses or growth stresses. These stresses arise because films are deposited under non-equilibrium conditions. In general, any redistribution of matter will result in film stresses, since the film is constrained by the substrate. A volume expansion of the thin film results in compressive stresses, while volume shrinkage results in tensile stresses.

10. The following passage of the publication "*Adhesion Aspects of Thin Films, Vol. 1,* pp. 1-16, Ed. K. L. Mittal, *0* VSP 2001" explains in more details such phenomena:

Consider a film on a substrate. The film is free of stress, with a thickness much smaller than that of the substrate (the thin film approximation) and lateral dimensions much larger than the total thickness of film and substrate. Imagine the film being removed from the substrate without dimensional changes and formation of stress. Thereafter, in the self-supporting state, the film experiences a volume change through the introduction of defects, a phase transformation or a change in temperature, see Fig. lb. Consider now the film being reattached to the substrate. As the lateral dimensions of the film and substrate are no longer the same, a biaxial stress (elastic isotropy is assumed in the plane of the film) is imposed on the film to elastically deform it back to the same dimensions as those of the substrate, see Fig.

1c. Notice that a volume expansion of the self-supporting thin film (as shown in Fig. 1 where eD is positive) results in compressive stresses, i.e. negative σ values, while a volume shrinkage results in tensile stresses (positive σ values). As long as the forces applied to deform the self-supporting film are still present, the stress in the reattached thin film does not change. When they are taken away, the normal tractions from the edges are removed and shear forces on the film/substrate interface near the edges are produced. These shear stresses supply the forces required to maintain the biaxial stress in the thin film and result in bending of the film /substrate composite. Tensile film stresses bend the substrate concavely upwards, compressive film stresses bend the substrate convexly outwards (Fig. 1).



11. Concerning now the doping of Si_3N_4 with zirconium, the addition of Zr in the material leads to the increase of the compressive stress, as indicated in the table 1 that gathers experimental data obtained by the applicant on the matter.

The first column corresponds to the reference material: Si_3N_4:Al (target 93 at% Si – 7 At% Al). The second column is the same material doped with Zr (target 76 at%Si – 17 at% Zr – 7 at% Al, i.e. Si/Zr = 4,5). Whatever the deposition pressure is, the addition of zirconium in silicon nitride leads to the increase of the compressive stress (negative values) as the addition of larger atoms (zirconium) in silicon nitride results in volume expansion of the material. Therefore, the compressive stress increase reaches +22% at low pressure and +46% at higher pressure.

	Si_3N_4:Al (MPa)	Si_3N_4:(Al.Zr) (MPa)
Low pressure ($1.5\ 10^{-3}$ mbar)	-820	- 1000
High pressure ($8\ 10^{-3}$ mbar)	-280	- 410

Table I : Compressive stress levels of Si_3N_4:Al and Si_3N_4:(Al.Zr) layers

12. While we have found that increased Zr content does increase intrinsic stress as well, however, the effect was not as great as would have been expected and indeed rather limited, contrary to what Wolfe teaches. Therefore, we have found that with the increased Zr content, we can achieve improvements in the optical properties of the antireflective stack as explained in my previous Declaration submitted in this case but also permit the heat treatments that are also required. That both of these features could be achieved with the increased Zr content, particularly, in view of Wolfe with or without the Joret citations, would not have been reasonably expected.

13. The undersigned petitioner declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false

statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

S. ROCHE

Signature

November 2nd, 2009

Date

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